CLAIMS

WE CLAIM:

1. A system for monitoring one or more physiological parameters for diagnosis of congestive heart failure within a patient, said system comprising:

   one or more implantable sensing devices, said sensing device comprising of at least one inductor coil and at least one sensor, with optional electronic components;

   a non-implantable readout device, said readout device comprising of at least one inductor coil allowing electromagnetic telecommunication and electromagnetic wireless powering.

2. A system for monitoring one or more physiological parameters for treatment of congestive heart failure within a patient, said system comprising:

   one or more implantable sensing devices, said sensing device comprising of at least one inductor coil and at least one sensor, with optional electronic components;

   a non-implantable readout device, said readout device comprising of at least one inductor coil allowing electromagnetic telecommunication and electromagnetic wireless powering.

3. The system of claim 1 wherein the implantable sensing device comprises of at least one capacitive sensor.

4. The system of claim 2 wherein the implantable sensing device comprises of at least one capacitive sensor.

5. The system of claim 1 wherein the implantable sensing device includes a battery.

6. The system of claim 5 wherein the battery is rechargeable using wireless means.

7. The system of claim 2 wherein the implantable sensing device includes a battery.

8. The system of claim 7 wherein the battery is rechargeable using wireless means.

9. The system of claim 1 wherein the physiological parameters include pressure.

10. The system of claim 2 wherein the physiological parameters includes pressure.

11. The system of claim 9 wherein one or more sensing devices are measuring one or more of the following pressures:

left ventricular end diastolic pressure,

left atrium,

left atrium appendage,

mean left atrium pressure,

left side of the heart,

right side of the heart,

right atrium,

mean right atrium pressure,

right ventricular end diastolic pressure,

differential pressure between left and right atrium.

12. The system of claim 11 wherein said system calculates the change of pressure over time (dp/dt).

13. The system of claim 10 wherein one or more sensing devices are measuring one or more of the following pressures:

left ventricular end diastolic pressure,

left atrium,

left atrium appendage,

mean left atrium pressure,

left side of the heart,

right side of the heart,

right atrium,

mean right atrium pressure,

right ventricular end diastolic pressure,

differential pressure between left and right atrium.

14. The system of claim 13 wherein said system calculates the change of pressure over time (dp/dt).

15. The system of claim 1 wherein the measurement of physiological parameters is used to tailor drug treatment of patients with congestive heart failure.

16. The system of claim 2 wherein the measurement of physiological parameters is used to tailor drug treatment of patients with congestive heart failure.

17. The system of claim 1 wherein a resonant scheme is used.

18. The system of claim 2 wherein a resonant scheme is used.

19. The system of claim 1 wherein a passive scheme is used.

20. The system of claim 2 wherein a passive scheme is used.

21. The system of claim 1 wherein an active scheme is used.

22. The system of claim 2 wherein an active scheme is used.

23. The system of claim 1 wherein the physiologic parameter being measured is one or more of the following parameters

pressure,

temperature,

flow ,

blood composition,

blood gas content,

chemical composition,

acceleration,

vibration.

24. The system of claim 2 wherein the physiologic parameter being measured is one or more of the following parameters

pressure,

temperature,

flow,

blood composition,

blood gas content,

chemical composition,

acceleration,

vibration.

25. The system of claim 1 wherein the location of said implantable sensing devices is one or more of the following:

atrial septum,

ventricular septum,

aorta,

left ventricle,

left atrium,

left atrium appendage,

right ventricle,

right atrium,

pulmonary artery,

wedge position in pulmonary artery.

26. The system of claim 2 wherein the location of said implantable sensing devices is one or more of the following

atrial septum,

ventricular septum,

aorta,

left ventricle,

left atrium,

left atrium appendage,

right ventricle,

right atrium,

pulmonary artery,

wedge position in pulmonary artery.

27. The system of claim 1 wherein said system is used for one or more of the following applications:

early diagnosis of a heart failing due to congestive heart failure related conditions,

early intervention in treatment of congestive heart failure related conditions,

tailoring of medications,

disease management,

identification of complications from congestive heart failure related conditions,

identification of complications from cardiovascular disease related conditions,

treatment of complications from congestive heart failure related conditions,

treatment of complications from cardiovascular disease related conditions,

feedback regarding the impact of medication on the heart,

pacing adjustments,

reduction in frequency and severity of hospitalizations due to cardiovascular diseases,

reduction in frequency and severity of hospitalizations due to congestive heart failure,

tuning of defibrillator or pacemaker parameters to improve congestive heart failure related conditions,

identification of mitral valve stenosis,

treatment of mitral valve stenosis including but not limited to surgery and balloon angioplasty.

28. The system of claim 2 wherein said system is used for one or more of the following applications:

early diagnosis of a heart failing due to congestive heart failure related conditions,

early intervention in treatment of congestive heart failure related conditions,

tailoring of medications,

disease management,

identification of complications from congestive heart failure related conditions,

identification of complications from cardiovascular disease related conditions,

treatment of complications from congestive heart failure related conditions,

treatment of complications from cardiovascular disease related conditions,

feedback regarding the impact of medication on the heart,

pacing adjustments,

reduction in frequency and severity of hospitalizations due to cardiovascular diseases,

reduction in frequency and severity of hospitalizations due to congestive heart failure,

tuning of defibrillator or pacemaker parameters to improve congestive heart failure related conditions,

identification of mitral valve stenosis,

treatment of mitral valve stenosis including but not limited to surgery and balloon angioplasty.

29. The system of claim 1 wherein said readout device is capable of performing one or more of the following:

remote monitoring of congestive heart failure patients, including but not limited to home monitoring,

monitoring of congestive heart failure patients with telephone-based (or similar method) data and information delivery,

monitoring of congestive heart failure patients with wireless telephone-based (or similar method) data and information delivery,

monitoring of congestive heart failure patients with web-based (or similar method) data and information delivery,

closed-loop drug delivery to treat congestive heart failure,

closed-loop pacemaker parameter tuning to treat congestive heart failure or congestive heart failure related conditions,

warning systems for critical worsening of congestive heart failure or congestive heart failure related conditions,

portable or ambulatory monitoring or diagnostic systems,

battery-operation capability,

data storage,

reporting global positioning coordinates for emergency applications,

communication with other medical devices including but not limited to pacemakers, defibrillator, implantable cardioverter defibrillator, implantable drug delivery systems, non-implantable drug delivery systems, and wireless medical management systems.

30. The system of claim 2 wherein said readout device is capable of performing one or more of the following

remote monitoring of congestive heart failure patients, including but not limited to home monitoring,

monitoring of congestive heart failure patients with telephone-based (or similar method) data and information delivery,

monitoring of congestive heart failure patients with wireless telephone-based (or similar method) data and information delivery,

monitoring of congestive heart failure patients with web-based (or similar method) data and information delivery,

closed-loop drug delivery to treat congestive heart failure,

closed-loop pacemaker parameter tuning to treat congestive heart failure or congestive heart failure related conditions,

warning systems for critical worsening of congestive heart failure or congestive heart failure related conditions,

portable or ambulatory monitoring or diagnostic systems,

battery-operation capability,

data storage,

reporting global positioning coordinates for emergency applications,

communication with other medical devices including but not limited to pacemakers, defibrillator, implantable cardioverter defibrillator, implantable drug delivery systems, non-implantable drug delivery systems, and wireless medical management systems.

31. The system of claim 1 incorporated into a closed-loop system with a left atrium to right atrium unidirectional valve for preventing the development of pulmonary edema.

32. The system of claim 2 incorporated into a closed-loop system with a left atrium to right atrium unidirectional valve for preventing the development of pulmonary edema.

33. The system of claim 1 wherein said non-implantable readout device includes a barometric pressure sensor.

34. The system of claim 33 wherein said barometric pressure sensor is used to compensate for variations in atmospheric pressure.

35. The system of claim 2 wherein said non-implantable readout device includes a barometric pressure sensor.

36. The system of claim 35 wherein said barometric pressure sensor is used to compensate for variations in atmospheric pressure.

37. The system of claim 1 wherein said implantable sensing device is implanted using a minimally invasive outpatient technique.

38. The system of claim 1 wherein a catheter delivery method is used to implant the implantable sensing devices.

39. The system of claim 2 wherein said implantable sensing device is implanted using a minimally invasive outpatient technique.

40. The system of claim 2 wherein a catheter delivery method is used method is used to implant the implantable sensing devices.

41. The system of claim 1, wherein said implantable sensing device uses anchoring mechanisms including but not limited to those used in one or more of the following:

septal occluder devices,

left atrial appendage occluders,

cardiac pacing leads,

screws,

tines,

stents.

42. The system of claim 41 wherein said anchoring mechanism utilizes an anchor that passes through a septum wall and opens on one or both sides of a septal wall, clamping said implantable device to the wall.

43. The system of claim 41 wherein said anchoring mechanism utilizes an anchor that passes through the atrial septum.

44. The system of claim 43 wherein the anchoring method is similar to anchoring of septum occluder devices, wherein two umbrella-shaped anchors one on each side which anchor the sensing device.

45. The system of claim 43 wherein the larger portion of said implantable sensing device is located in the right side of the heart and the smaller portion of said implantable sensing device is located in the left side and includes at minimum one sensor, in order to minimize the risk of thrombogenicity.

46. The system of claim 41 wherein said anchoring mechanism is a helical screw.

47. The system of claim 41 wherein said anchoring mechanism is a tine that expands and catches on a tribeculated area of the heart.

48. The system of claim 41 wherein said anchoring mechanism is made from one or more or any combination thereof the following materials:

nitinol,

teflon,

stainless steel,

polymer,

titanium,

biocompatible metals.

49. The system of claim 2, wherein said implantable sensing device uses anchoring schemes including but not limited to those used in one or more of the following

septal occluder devices,

left atrial appendage occluders,

cardiac pacing leads,

screws,

tines,

stents.

50. The system of claim 49 wherein said anchoring mechanism utilizes an anchor that passes through a septum wall and opens on one or both sides of a septal wall, clamping said implantable device to the wall.

51. The system of claim 49 wherein said anchoring mechanism utilizes an anchor that passes through the atrial septum.

52. The system of claim 51 wherein the anchoring method is similar to anchoring of septum occluder devices, wherein two umbrella-shaped anchors one on each side which anchor the sensing device.

53. The system of claim 51 wherein the larger portion of said implantable sensing device is located in the right side of the heart and the smaller portion of said implantable sensing device is located in the left side and includes at minimum

54. The system of claim 49 wherein said anchoring mechanism is a helical screw.

55. The system of claim 49 wherein said anchoring mechanism is a tine that expands and catches on a tribeculated area of the heart.

56. The system of claim 49 wherein said anchoring mechanism is made from one or more or any combination thereof the following materials:

nitinol,

teflon,

stainless steel,

polymer,

titanium,

biocompatible metals.

57. The system of claim 1 wherein said implantable sensing device is augmented with one or more actuators including but not limited to:

thermal generators,

voltage sources,

current sources,

probes,

electrodes,

drug delivery pumps,

valves,

meters,

microtools for localized surgical procedures,

radiation emitting sources,

defibrillators,

muscle stimulators,

pacing stimulators.

58. The system of claim 2 wherein said implantable sensing device is augmented with one or more actuators including but not limited to

thermal generators,

voltage sources,

current sources,

probes,

electrodes,

drug delivery pumps,

valves,

meters,

microtools for localized surgical procedures,

radiation emitting sources,

defibrillators,

muscle stimulators,

pacing stimulators.

59. The system of claim 1 wherein said system is part of a closed-loop pacing/ICD (implantable cardioverter defibrillator) tuning mechanism wherein said sensor data is sent to a patient pacemaker for tailoring of pacing/ICD function.

60. The system of claim 59 wherein said sensor is directly interrogated by the pacing/ICD unit.

61. The system of claim 59 wherein said sensor is interrogated by the pacing/ICD unit wherein an additional external unit is used for the sole purpose of transmitting power to said sensor.

62. The system of claim 59 wherein said sensor transmits data to an external reader, after which said reader retransmits data to the pacing/ICD unit.

63. The system of claim 62 wherein said external reader said pacing/ICD unit perform at least one function of interrogation or powering of the sensor.

64. The system of claim 2 wherein said system is part of a closed-loop pacing/ICD (implantable cardioverter defibrillator) tuning mechanism wherein said sensor data is sent to a patient pacemaker for tailoring of pacing/ICD function.

65. The system of claim 64 wherein said sensor is directly interrogated by the pacing/ICD unit.

66. The system of claim 64 wherein said sensor is interrogated by the pacing/ICD unit wherein an additional external unit is used for the sole purpose of transmitting power to said sensor.

67. The system of claim 64 wherein said sensor transmits data to an external reader, after which said reader retransmits data to the pacing/ICD unit.

68. The system of claim 67 wherein said external reader said pacing/ICD unit perform at least one function of interrogation or powering of the sensor.

69. The system of claim 1 wherein at least a portion of said implantable sensing device is coated with one or more layers of thin coatings.

70. The system of claim 69 wherein the coating materials include but are not limited to one or more or any combination thereof:

silicone,

hydrogels,

parylene,

polymer,

nitrides,

oxides,

nitric-oxide generating materials,

carbides,

silicides,

titanium.

71. The system of claim 2 wherein at least a portion of said implantable sensing device is coated with one or more layers of thin coatings

72. The system of claim 71 wherein the coating materials include but are not limited to one or more or any combination thereof:

silicone,

parylene,

hydrogels,

polymer,

nitrides,

oxides,

nitric-oxide generating materials,

carbides,

silicides,

titanium.